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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/049,615	02/21/2002	Hiroshi Yoshida	011362	2567

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1722	

DATE MAILED: 05/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/049,615	YOSHIDA ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/7/2005 has been entered.

Specification

2. The amendment filed 1/7/2005 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "would enable" and "would make" in the Problems solved by the invention section. The change in tense from "enables" and "makes" is new matter.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-2 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the

invention. Claim 1 recites a single crystal zinc oxide material that contains 1 to 99 mol% manganese in claims 1 and 2. It is unclear how a zinc oxide material can contain 99 mol % manganese. A crystal with 99 mol% manganese would be a manganese oxide crystal and not a zinc oxide crystal.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,679,965) in view of White et al (US 6,291,085) and Fujimura et al ("Exotic Doping For ZnO Thin Films: Possibility of Monolithic optical integrated circuit").

In a method of growing ZnO, Schetzina teaches a substrate is held between 300-900°C for monocrystalline growth of ZnO using MBE (col 19, ln 1-50), this reads on applicants' single crystal ZnO.

Schetzina does not teach a p-type dopant selected from the group consisting of C, N and oxides thereof.

In a method of making a p-type ZnO, White et al teaches doping a ZnO film with a p-type dopant, such as Nitrogen (col 4, ln 5-25). White et al also teaches the net acceptor concentration of between about 10^{18} and 10^{21} acceptors/cm^3 and a resistivity of no more than 1 ohm-cm (col 5, ln 45-60). White et al also teaches MBE, MBE with laser ablation, CVD and MOCVD can be used to fabricate the ZnO layer (col 7, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Schetzina's single crystalline ZnO layer by doping with p-type dopant, as taught by White et al, because a p-type ZnO layer is useful as a light emitting diode and has a lower resistivity (col 1, ln 10-20 and col 2, ln 10-20).

The combination of Schetzina and White et al does not teach the p-type single crystal ZnO comprises 1 to 99 mol% manganese.

In a method of doping ZnO, note entire reference, Fujimura et al teaches a magnetic ZnO semiconductor by doping with magnetic elements, such as Mn (pg 320-321). Fujimura et al also teaches resistivity control by doping with p-type dopants, such as N, and n-type dopants, such as B, In, Sc and Al, to improve the ferroelectric properties and co-doping of acceptors and donors makes an acceptor-donor complex which may produce shallower levels to solve this problem (pg 321-322). It would have been obvious to a person of ordinary skill in the art at the time of the

invention to modify the combination of Schetzina and White et al by doping ZnO with Mn to make the ZnO magnetic, as taught by Fujimura et al.

The combination of Schetzina, White et al and Fujimura et al does not teach the concentration of manganese is 1-99 mol%. Concentration is well known in the art to be a result effective variable. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schetzina, White et al and Fujimura et al by optimizing the amount of manganese to obtain the claimed concentration by conducting routine experimentation of a result effective variable (MPEP 2144.05).

The combination of Schetzina, White et al and Fujimura et al is silent to the pressure and partial pressure. Pressure and partial pressure of reactants are well known in the art to be result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schetzina, White et al and Fujimura et al by optimizing the pressure and partial pressure to obtain the claimed pressure and partial pressure by conducting routine experimentation of result effective variables (MPEP 2144.05).

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1-2 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Fujimura et al ("Exotic Doping For ZnO Thin Films: Possibility of Monolithic optical integrated circuit").

US 6,527,858 claims a p-type ZnO single crystal comprising a zinc oxide that contains a p-type dopant composed of nitrogen or carbon and an n-type dopant compose of any one or more elements selected from a group consisting of boron, aluminum, and gallium. US 6,527,858 also claims the hole concentration is $1x10^{17}$ holes/cm^3 or more and the electric resistivity is lower than 100 ohm-cm.

US 6,527,858 does not claim a ferromagnetic p-type consisting of 1-99% manganese.

In a method of doping ZnO, note entire reference, Fujimura et al teaches a magnetic ZnO semiconductor by doping with magnetic elements, such as Mn (pg 320-321). Fujimura et al also teaches resistivity control by doping with p-type dopants, such as N, and n-type dopants, such as B, In, Sc and Al, to improve the ferroelectric properties and co-doping of acceptors and donors makes an acceptor-donor complex which may produce shallower levels to solve this problem (pg 321-322). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify US 6,527,858 by doping ZnO with Mn to make the ZnO magnetic, as taught by Fujimura et al.

The combination of US 6,527,858 and Fujimura et al does not teach the concentration of manganese is 1-99 mol%. Concentration is well known in the art to be a result effective variable. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858 and Fujimura et al by optimizing the amount of manganese to obtain the claimed concentration by conducting routine experimentation of a result effective variable (MPEP 2144.05). Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

The combination of US 6,527,858 and Fujimura et al teaches a hole concentration of $1x10^{17}$ holes/cm^3 or more and the electric resistivity is lower than 100 ohm-cm. Overlapping ranges are held to be obvious (MPEP 2144.05).

9. Claims 3-4 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Fujimura et al ("Exotic Doping For ZnO Thin Films: Possibility of Monolithic optical integrated circuit"), as applied to claims 1-2 above, and further in view of Schetzina (US 5,679,965).

The combination of US 6,527,858 and Fujimura et al teaches all of the limitations of claim 3, as discussed previously, except the operating parameters of a substrate held within a temperature range of 300-800°C in a vacuum atmosphere of about 10^{-8} Torr and the partial pressure of the reactants.

In a method of growing ZnO, note entire reference, Schetzina teaches a substrate is held between 300-900°C for monocrystalline growth of ZnO using MBE (col 19, ln 1-50). It would

have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858 and Fujimura et al with Schetzina's teaching of a substrate temperature of 300-900°C to produce an expected result.

The combination of US 6,527,858, Fujimura et al and Schetzina is silent to the pressure and partial pressure. Pressure and partial pressure of reactants are well known in the art to be result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858, Fujimura et al and Schetzina by optimizing the pressure and partial pressure to obtain the claimed pressure and partial pressure by conducting routine experimentation of result effective variables (MPEP 2144.05).

Terminal Disclaimer

10. The terminal disclaimer filed on 1/7/2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 6,527,858 has been reviewed and is NOT accepted.

11. An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c).

Response to Arguments

12. Applicant's arguments, see page 5 of the remarks, filed 1/7/2005, with respect to the rejection over Applicant's admitted prior art have been fully considered and are persuasive. The rejection of claims 1-4 has been withdrawn.

13. Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Fuji (JP 07-288259) teaches a molecular beam epitaxy of a Group II-VI semiconductor using a chamber pressure of 10^{-7}-10^{-9} Torr (English Abstract and [0008]).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 571-272-1137. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
May 24, 2005

ROBERT KUNEMUND
PRIMARY EXAMINER